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FISH DIVERSITY AND ITS CONSERVATION IN UYYAKKONDAN CHANNEL, TIRUCHIRAPPALLI DISTRICT, TAMILNADU

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ABSTRACT

Inland water and freshwater biodiversity acts as a valuable natural resource. Today, manmade intervention has resulted in degradation of most freshwater systems which in turn affects the structure and function of these systems. As fish communities are very good indicators of this disturbance, the present study was conducted to analyse the distribution and diversity of fishes occurring in Uyyakkondan channel. Among the three sites, site 1 recorded 9 species, site 2 recorded 14 species and site 3 recorded 15 species. In all the three sites, Cyprinidae dominated. Shannon Weiner index (H) was maximum in site1 as also Simpson’s Dominance index (D) while Simpsons index for diversity (I-D) was highest in site 3.

KEYWORDS: Fish diversity, Uyyakkondan Channel, Conservation, Water Quality

INTRODUCTION

India is one of the major countries in the world with vast and diverse natural inland water resources covering a total estimated area of 4.5 x 10^6 ha (Jhingran, 1991). With the exploding human population, India will have to utilize all the avenues for increasing the food production. Aquaculture based on abundant water resources will play an increasingly bigger role as fish farming is a source of cheap animal protein in human diets in times to come (Singh *et al.,* 1994). In addition, fishes also contribute an important role in the economy of many nations throughout the world. According to Nelson (2006), fishes constitute more than half of the total number of the approximately 54,711 recognized living vertebrate species of which there are descriptions of an estimated 27,977 species of fishes.

Inland waters and freshwater biodiversity acts as a valuable natural resource. Today, human activities have resulted in the degradation of most fresh water systems which in turn affects structure and function of these systems. This has brought about drastic reduction in many aquatic species (Shukla and Singh, 2013). In addition, further extinction in species could also be caused due to increasing temperatures, reduced precipitation and the enormous amount of with drawal of water for agricultural purposes (Vorosmarty *et al*., 2000; Alcamo *et al*., 2003).

As aquatic communities and more specifically fish communities are very good indicators of disturbance, their study can effectively depict a comprehensive account of aquatic ecosystem structure and function. Hence the present study was conducted to analyse the distribution and diversity of fishes occurring in Uyyakkondan channel in Triuchirappalli District, Tamil Nadu.

MATERIAL AND METHODS

Data Collection and Analysis

Fish sampling was performed in 100m reach of all the three sampling sites. Fishes were collected from different selected localities during the period from December 2011 to September 2012 with the help of local fishermen using different types on nets namely gill nets, cast nets and dragnets. Photographs were taken prior to preservation as formalin decolorizes the fish. Fishes brought to the laboratory were fixed in this solution in separate jars according to the size of species. Smaller fishes were directly placed in the formalin solution while larger fishes were given an incision on the abdomen before they were fixed. The fishes were labeled giving serial numbers, exact locality from where collected, date of the collection and the local name of fish used in this region. Identification of fishes where carried out by following Talwar and Jhingran (1991).

Water samples were collected between 8 and 9 am and transported to the laboratory immediately for further analysis. Water temperature was measured at the time of sampling using mercury thermometer while pH was measured with standard pH meter. Other parameters were analyzed in the laboratory according to the methods suggested by American Public Health Association (APHA, 1992).

Fish were subjected to diversity analysis using different indices like Shannon – Weiner index (H) (1963), Simpson Dominance index (D) and Simpson index of diversity (I-D) (1949).

Shannon – Weiner index was calculated by using the formula:

$H = \Sigma p_i \log 2P_i$

Where, H = Shannon - Weiner index

Pi = ni /N

ni = Number of individuals of each species in the sample

N = Total number of individuals of all species in the sample.

Abundance of fish population was calculated by the sum of all available fishes in different sites. Species richness was simply estimated by the variety of fish species in three different sites.

Data regarding threats faced by the fish fauna were obtained from both primary (direct observations and interaction with local stakeholders and fishermen) and secondary sources.

Simpson's Diversity Index: Simpson's diversity index is a measure of diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species.

Simpson's index of dominance was calculated by using the formula:

$$D = \Sigma \frac{ni(ni-1)}{N(N-1)}$$

Where:

ni = the total number of individuals of a particular species.

N = the total number of individuals of all species.

Simpson's index of diversity = 1-D

RESULTS

During the period of study a total of 15 species of fish belonging to 10 families were recorded from the three sampling sites (Table 1). Of these, site 1 (Pettavathalai region) recorded a total of 9 species, while site 2 (Ayilapettai region) a total of 14 species and site 3 (Vayalur region) recorded a total of 15 species. Among the various families, family Cyprinidae recorded the maximum number of species (3) followed by the family Clariidae (2). All other families were recorded by only one species of the 9 species that were recorded in site 1, three belonged to the family Cyprinidae, two to Clariidae and one each to family Saccobrachidae, Clupeideae, Sisonidae and Ophiocephalidae. In site 2, of the 14 species that were recorded, five belonged to the family Cyprinidae, two to Clariidae and Sironidae and one each to Saccobrachidae Siluridae, Clupeidae, Ophiocephalidae, Amphipnoidae and Centropomidae.

Thus an overall comparion between the three sites reveals that in all the sites Cyprinidae dominated. Comparing the percentage occurrence in various sites reveals that in site 1, cyprinids formed 53.57% of the total fish species followed by clariids and clupeids with 14.28% each and ophiocephalids with 10.71% while saccobrachids and sisorids recorded the lowest percentage with 3.58% each.

In site 2 also, the bulk of the fish anaysed belonged to cyprinids (50.84%) followed by clarids (11.86%) and saccobrachids (10.27%). This was followed by sisorids and ophiocephalids (8.47% each), centropomids (5.08%) and clupeids (1.69%). Thus, the hierarchy noticed here was Cyprinidae > Claridae> Saccobrachidae> Sisoridae = Ophiocephalidae > Centropomidae > Siluridae> Clupeidae.

In site 3 also, the majority of the fishes analysed belonged to Cyprinidae (51.94% followed by Claridae (24.67%), Clupeidae (6.54), Sisoridae and Ophiocephalidae (38.9% each), Amphipnoidae and Centropomidae (2.59% each) and Siluridae (1.29%). Thus the hierarchy was Cyprinidae > Claridae> Clupeidae > Sisoridae = Ophiocephalidae > Amphipnoidae = Centropomidae > Siluridae.

The Shannon – Weiner index (H) among the three sites was found to range from 0.008 to 0.032. While the lowest index was found in site 3 (0.008) the highest was recorded in site 1 (0.032) Staub *et al.* (1970) proposed a scale in terms of species diversity according to which a value ranging between 0 - 1 indicates heavily pollution. Based on Staub *et al.* (1970), all the three sites in the present study can be termed as heavily polluted. Simpsons dominance index (D) value was found to be highest in site 1(0.072) and lowest in site 3 (0.014). In this index, 0 represents infinite diversity and 1 no diversity. With regard to Simpsons index of diversity (I-D), site 3 recorded the highest diversity (0.99) and site 2 the lowest (0.82). The value of this index also ranges between 0 and 1 with greater the value the higher being the sample diversity.

The seasonal variation in the various physico-chemical variables analyzed during the three seasons of the year are presented in Tables 2 and 3 The surface water in site 1 was found to range from 25.5^{0}C (winter) to 29.5^{0}C (summer) in site 2 from 26^{0}C (winter) to 29.5^{0}C (summer) and in site 3 from 26^{0}C (winter) to 29.5^{0}C (summer). While the pH was found to vary from 7.4 (rainy) to 8.8 (summer) in site 1, it varied from 7.7 (winter) to 8.5 (summer) in site 2 and from 7.6 (winter & rainy) to 8.4 (summer) in site 3. The suspended solids on the other hand was found to vary from 4.6 (summer) to 5.3g/l (winter) in site 1, from 2.6 (winter) to 3.6 g/l (rainy) in site 2 and from 2.7 (winter) to 3.8 g/l (summer) in site 3.

Dissolved oxygen levels in site 1 varied from 4.4 (rainy) to 5.1 mg/l (winter), from 5.4 (summer) to 6.6 mg/l (winter) in site 2 and from 5.3 (summer) to 6.8 mg/l (winter) site3. BOD levels ranged from 29 (site 2) to 120 mg/l (site 1) and COD from 84 (site 1) to 240 mg/l (site 1). While the minimum BOD and COD levels were noticed during the rainy season, the maximum BOD and COD levels in all the three sites were uniformly recorded in summer season.

DISCUSSIONS

According to the IUCN ‘Red list of threatened animals’ (Baillie and Groom bridge, 1996) about 20% are freshwater fishes. Abiotic and biotic factors have an important role in supporting fish diversity and fish culture in lake ecosystems (Prasad *et al.,* 2009). Physico-chemical variables like pH and dissolved oxygen are key habitat features correlated with fish diversity and found to be the most important variables in shaping fish distribution. A perusal of the water temperature reveals that it varied from 25.5 to 29.5^{0}C in all the 3 sites. According to Sharma and Gupta (1994) the ideal temperature for growth is in the range of 14.5 to 38.6^{0}C. Taking this into consideration all the three sites recorded favorable temperatures for fish growth. pH during the period of study was found to range between 7.4 and 8.8. According to Jhingran (1983), a value between 7 to 9 units is suitable for aquaculture. Based on this observation all the three sites are suitable for fish growth. The DO levels in the three sites varied from 4.4 to 6.8 mg/l. Welch (1952) based on several thousand determinations made on land water in central US, opined that DO levels of 3 ppm or lower should be regarded as hazardous to lethal under average stream and lake conditions and that 5 mg/l or more should be present in waters if the conditions are to be favourable for fresh water fishes. It is needless to point out that DO levels in all the three sites were above 3 mg/l throughout the year in all the three sites.

Jhingran (1983) also suggested that high siltation can cause an adverse effect on fish production as it can cause respiratory problems in fishes even if sufficient DO is present. During the present investigation it was fund that the site 1 had the highest siltation rates when compared to the other two sites. Further, discharge of untreated sewage can also cause depletion of oxygen content and an increase in BOD values and threaten the existence of aquatic life (Prasad *et al.,* 2009). This is probably the reason why site 1 recorded low DO and high BOD levels. According to Shukla and Singh (2013), COD is useful in pinpointing toxic conditions and the presence of biochemically resistant substances. In the present investigation COD was maximum in site 1.

Thus it can be suggested that the health of the environment can decide the diversity and productivity of a system. Hence for sustaining and maintaining the diversity of aquatic organisms, it is important to know the factors that control the quality of life in these systems (Prasad *et al.,* 2009).

The best approach to the conservation of species is to disseminate conservation information, education and practices to fisherman and other stake holders about the danger of extinction of species and the need for its conversation as prevention is not only better but also cheaper than looking for ways for recalling the lost species (Shukla and Singh, 2013). Thus a holistic approach in the management and conservation of the ecosystem is the need of the hour if these species of aquatic organisms are to the preserved.

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APPENDICES

Table 1: Fish Species Richness, Abundance and Biodiversity Indices of Uyyakkondan Channel

River	Site1	Site2	Site3
Species Richness	9	15	15
Abundance	32	107	142
Shannon-Winter index(H)	0.032	0.010	0.008
Simpson's index of dominance (D)	0.072	0.032	0.014
Simpson's index of diversity (1-D)	0.94	0.82	0.99

Table 2: Fish Species Density, Abundance, Richness and Distribution in Uyyakkondan Channel

No	Species	Site-1	Site-2	Site-3	Richness	Abundance
	Family Cyprinidae					
1	*Catla catla*	6	8	10	3	24
2	*Labeo rohita*	4	17	18	3	39
3	*Cirrhinus mrigala*	5	9	4	3	18
4	*Labeo calbasu*	0	4	4	2	8
5	*Chela atpar*	0	2	4	2	6
	Family Saccobrachidae					
6	*Heteropneutes fossilis*	1	6	2	3	9
	Family Clariidae					
7	*Clarias batrachus*	2	4	13	3	19
8	*Mystus bleekeri*	2	3	6	3	11
	Family-Siluridae					
9	*Wallago attu*	0	2	1	2	3
	Family-Clupeidae					
10	*Gudusia chapra*	4	1	5	3	10
	Family Sisoridae					
11	*Ompok bimaculatus*	0	1	1	2	2
12	*Bagarius bagarius*	1	4	2	3	7
	Family Ophiocephalidae					
13	*Channa punctatus*	3	5	3	3	11
	Family-Amphipnoidae					
14	*Macrognathus aculeatus*	0	4	2	2	6
	Family-Centropomidae					
15	*Chanda hama*	0	3	2	2	5

Table 3: Seasonal Variations of Phycio-Chemical Parameters of Uyyakondan Channel

Season	pH			Temperature ^{0}C			Suspended Solids (g/l)		
	S1	S2	S3	S1	S2	S3	S1	S2	S3
Pre summer	7.6	7.7	7.6	25.5	26.0	26.0	5.3	2.6	2.7
Summer	8.8	8.5	8.4	29.5	29.5	29.5	4.6	3.4	3.8
Rainy	7.4	7.8	7.6	28.0	28.0	28.0	5.2	3.6	3.7

Table 4: Seasonal Variations of Phycio-Chemical Parameters of Uyyakondan Channel

Season	Total Dissolved Oxygen(mg/l)			BOD (mg/l)			COD (mg/l)		
	S1	S2	S3	S1	S2	S3	S1	S2	S3
Pre summer	5.1	6.6	6.8	112	72	60	160	110	106
Summer	4.9	5.4	5.3	120	78	67	240	190	194
Rainy	4.2	5.6	5.7	46	29	30	84	90	98

Where S1 -Site1 S2-Site2 S3-Site3